

What is claimed is:

1. An apparatus for embedding a watermark into an original audio signal, comprising:

5 a linear prediction analysis means for generating a prediction coefficient of the original audio signal by means of a linear prediction analysis after the original audio has been inputted thereto;

10 a residual signal output means for outputting a residual signal of a delayed original audio signal by filtering the delayed original audio signal using the prediction coefficient generated from the linear prediction analysis means;

15 an echo signal generation means for generating an echo signal of the original audio signal by synthesizing the prediction coefficient of the original audio signal and the residual signal of the delayed required audio signal; and

20 a copyright information insertion means for generating a watermarked audio signal by combining the original audio signal and the echo signal of the original audio signal having copyright information therein.

25 2. The apparatus as recited in claim 1, wherein the linear prediction analysis means generates the prediction coefficient which is able to predict an inherent spectrum of the audio by virtue of the linear prediction analysis.

3. The apparatus as recited in claim 1, wherein the

residual signal output means includes:

a delay means for delaying the original signal for a predetermined delay time (τ); and

a linear prediction analysis filter for outputting the residual signal by eliminating the inherent spectrum of the delayed original audio signal after filtering the delayed original audio signal using the prediction coefficient.

4. The apparatus as recited in claim 3, wherein the predetermined delay time (τ) is a detection key of the watermark.

5. The apparatus as recited in claim 1, wherein the echo signal generation means is a linear prediction synthesis filter for outputting the echo signal of the original audio signal by synthesizing the prediction coefficient of the original audio signal outputted from the linear prediction analysis means and the residual signal of the delayed original audio signal outputted from the residual signal output means.

6. The apparatus as recited in claim 1, wherein the copyright information insertion means includes:

an error correction encoder for granting an error correction function to the copyright information embedded into the original audio signal;

a sign generator for assigning a sign to the echo signal of the original audio signal outputted from the echo signal

generation means according to an error-corrected copyright information outputted from the error correction encoder; and

a summer for outputting a watermarked audio signal by adding a sign-assigned signal outputted from the sign generator and the original audio signal.

7. The apparatus as recited in claim 6, wherein the error correction encoder outputs each different value, i.e., 0 or 1, according to the copyright information, the sign generator assigns a positive sign or a negative sign to the echo signal of the original audio signal and the summer outputs the watermarked audio signal having the copyright information therein by adding the echo signal to the original audio signal or subtracting the echo signal from the original audio signal.

8. A method for embedding a watermark into an original audio signal, the method comprising the steps of:

a) generating a prediction coefficient of the original audio signal by means of the linear prediction analysis;

b) outputting a residual signal of a delayed audio by filtering the delayed original audio signal and eliminating an inherent spectrum of the audio signal, using the prediction coefficient of the original audio signal;

c) outputting a synthesis signal by using the prediction coefficient of the original audio signal and the residual signal of the delayed original audio signal;

d) granting an error correction function to the copyright information;

e) assigning a sign to the synthesis signal after an error corrected copyright information is inputted thereto; and

5 f) outputting a watermarked audio signal by adding the original audio signal and the synthesis signal that a predetermined sign has been assigned.

9. An apparatus for detecting a watermark from a watermarked audio signal using an echo signal of a delayed original audio that is delayed for a predetermined delay time (τ), the apparatus comprising:

10 a linear prediction analysis means for generating a prediction coefficient by means of the linear prediction analysis of the watermarked audio signal;

15 a linear prediction analysis filter for outputting a residual signal by eliminating an inherent spectrum of the original audio signal after filtering the watermarked audio signal using the prediction coefficient;

20 a short-time autocorrelation means for calculating an autocorrelation using the residual signal outputted from the linear prediction analysis filter; and

25 a sign detection means for detecting the copyright information after detecting a sign of the value outputted from the short-time autocorrelation means.

10. The apparatus as recited in claim 9, further

includes an error correction decoder for outputting the error-corrected copyright information through an error-correction decoding step after the resultant output sign detected from the sign detector 204 is inputted thereinto.

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11. The apparatus as recited in claim 9, wherein the linear prediction analysis means generates the residual signal in which the residual signal of the original audio signal and the residual signal of the delayed original signal.

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12. The apparatus as recited in claim 11, wherein the short-time autocorrelation means finds out the residual signal of the original audio signal and the residual signal of the delayed original audio signal by calculating the autocorrelation of the residual signal.

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13. The apparatus as recited in claim 11, wherein the sign detection means investigates a correlation sign of the residual signal of the original audio signal and the residual signal of the delayed original signal, thereby outputting an output value, i.e., 0 or 1, according the correlation sign.

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14. A method for detecting a watermark from a watermarked audio signal using a residual signal of a delayed original audio signal that is delayed for a predetermined delay time (τ), the method comprising the steps of:

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a) generating a prediction coefficient by means of a

linear prediction analysis of the watermarked audio signal;

b) outputting a residual signal by eliminating an inherent spectrum of the audio signal after filtering the watermarked audio signal using the prediction coefficient;

5 c) calculating an autocorrelation using the residual signal; and

d) detecting the copyright information after detecting a sign of the value outputted from the short-time autocorrelation means.

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